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GLOBAL IMPACT OF THE ANTARCTIC OZONE HOLE: SIMULATIONS WITH A 3-D CHEMICAL TRANSPORT MODEL

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A study of the Antarctic ozone hole has been made with a 3-D chemical transport model using linearized photochemistry for ozone based on observed distributions. The tracer model uses the winds and convection from the GISS general circulation model (8° × 10° × 23 layers). A 3-year control run of the ozone distribution is compared with the observed climatology. In two experiments, a hypothetical Antarctic ozone "hole" is induced on October 1 and on November 1; the tracer model is integrated for 1 year with the standard, linearized chemistry. The initial depletion, 90% of the O_3 poleward of 70°S between 25 and 180 mbar, amounts to about 5% of the total O_3 in the Southern Hemisphere. As the vortex breaks down and the "hole" is dispersed, significant depletions to column ozone, of order 10 D.U., occur as far north as 36°S during Austral summer. One year later, about 25% of the original depletion remains, mostly below 100 mbar and poleward of 30°S. Details of the calculations will be shown, along with a budget analysis showing the fraction of the "hole" filled in by photochemistry versus that transported into the troposphere.

Table. Dobson Map of the Dispersion of an Antarctic Ozone Hole: Initialized November 1

(Units are negative D.U. relative to control climatology)

lat.	Nov1	Dec1	Jan1	Feb1	Mar1	Apr1	May1	Jun1	Jul1	Aug1	Sep1	Oct1	Nov1
4S	0	0	0	0	0	0	0	0	0	0	0	0	0
12S	0	0	0	0	0	0	0	0	0	0	0	0	0
20S	0	0	0	1	1	1	0	0	0	0	0	0	0
28S	0	0	2	2	2	2	2	2	2	2	2	2	2
36S	0	1	4	6	6	7	6	7	6	6	5	5	4
44S	0	7	11	11	11	11	10	10	9	8	7	6	5
52S	0	17	20	16	16	14	14	12	10	9	8	7	6
60S	0	31	26	22	19	17	16	13	12	9	9	7	6
68S	0	46	29	27	21	20	18	16	13	12	10	8	7
76S	242	59	33	28	22	20	19	17	15	13	11	9	7
84S	235	109	60	33	29	25	19	18	16	15	12	10	7
90S	212	160	88	42	33	29	14	15	18	16	11	9	7